CLAIMS

What Is Claimed Is:

1. A method for reducing the uncertainty in the timing on a network, comprising the steps of:

time stamping arriving packets before sending the packets to a receive buffer; and

giving the packets a timestamp which is set in the future, and holding the packets until precisely that time before transmitting them.

2. The method of claim 1 wherein no changes are made to physical layer drivers or to any of standard network protocol rules for packet structure, at all network layers.

3. A method for ensuring time precision on standard network protocol layered networks, comprising the steps of:

sending information packets from a transmit buffer to a receive buffer on a network, wherein said network follows the standard network protocol rules for networks; and

releasing time packets at a host physical layer to a network boundary at the time specified within the packet.

4. The method of claim 3, comprising the steps of:

differencing a Receive Timestamp of a Network Time Server and an Originate Timestamp of a Network Time Client, said difference being a receive time difference;

differencing a Reference Timestamp of the Network Time Client and a Transmit Timestamp of the Network Time Server, said difference being a transmit time difference;

differencing overall the receive time difference and the transmit time difference wherein said overall difference is a hardware transmission line delay when the Network Time Client and Network Time Server are synchronized; and

synchronizing the Network Time Client and Network Time Server by adjusting the transmission line delay between transmit and receive are equal to each other.

5. A method for application to existing packet based network time protocols, comprising the steps of:

placing an auxiliary time stamp on an information packet, the placement and reading of said auxiliary timestamp being transparent to the existing network time protocols;

determining when an information packet is received at a physical interface by applying said timestamp to the packet at the time of packet reception at the physical interface; and

determining when an information packet is sent from at a physical interface by fixing said packet timestamp to be the time at which the packet will be released for transmission from the physical interface.

6. The method of claim 1 wherein no changes are made to physical layer drivers or to any of standard network protocol rules for packet structure, at all network layers.

7. An apparatus for reducing the uncertainty in timing on a network comprising:

an auxiliary receive timestamper for applying an auxiliary timestamp to arriving packets before sending the packets to a receive

buffer, wherein said auxiliary time stamper is in addition to any existing network protocol timestamp;

an auxiliary transmit timestamper adapted to apply a future timed auxiliary timestamp for packets to be transmitted; and

a network transmitter for packets adapted to transmit packets for release from the physical interface according said auxiliary transmitter timestamps, and adapted to hold the packets until the time of the auxiliary transmit timestamp before transmitting said packets.

8. The apparatus of claim 7 wherein:

a network adapted to run according to standard network protocol rules, including packet structure rules; and

a media access controller extender apparatus transparent in operation to existing hardware, said media access controller extender being adapted to supply auxiliary timestamps and utilize said auxiliary timestamps to reduce timing uncertainty on a network.

9. An apparatus for ensuring time precision on standard network protocol layered networks comprising :

means for transmitting information packets from a transmit buffer to a receive buffer on a network, wherein said network follows the standard network protocol rules for packets and networks; and

an auxiliary apparatus for information packets, wherein said apparatus is adapted to release the packet at a host physical layer to a network boundary at an auxiliary time specified for the packet by said auxiliary apparatus.

10. The apparatus of claim 8 comprising:

a first auxiliary differencing unit which differences an auxiliary Receive Timestamp of a Network Time Server and an auxiliary Originate Timestamp of a Network Time Client; and

a second auxiliary unit which differences an auxiliary Reference Timestamp of a Network Time Client and auxiliary Transmit Timestamp of a Network Time Server; and

a synchonization checker; said checker formed by differencing first and second auxiliary differencing units; said Network Time Client and said Network Time Server being synchronized so that synchroniztion checker indicates a hardware transmission line delay only, the line delay between the transmit and receive being precisely equal to each other.

11. The apparatus of claim 9 wherein:

said receive and said transmit timestamps are adapted to reduce time uncertainty in packet reception and transmission, said transmit and receive times are transmit and receive times of packets at physical interfaces, thereby preventing unknown delays which might arise from the network application layers, timestamps being supplied after the packet leaves the application layer or being read before the packet enters the application layer.

12. An apparatus for application to existing packet based network time protocols comprising:

auxiliary timestampers adapted to place a timestamp on an information packet, said auxiliary timestampers being adapted to be transparent to the existing network time protocols;

an auxiliary receive timestamper, wherein a timestamp is placed on an information packet when aid packet is received at a physical interface;

an auxiliary transmit timestamp, wherein packets are timestamped for future transmission by timestamping packets with a future time; and

an auxiliary tranmit-releaser adapted to release packets at a physical interface, wherein said future timestamped packets are released as their future time becomes the present.